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UNIFORM TIME.

The question of the introduction of uniform standard time into daily use, for both popular and scientific purposes, having been examined by the American Metrological Society, the president, Prof. F. A. P. Barnard directs attention to the following considerations, and invites exchange of views upon this subject.

He says "local time," in the astronomical sense of this term, varies with every change of meridian; it can therefore not be conveniently retained by travellers, and transportation and telegraph companies, which adopt whatever meridian may be the most convenient Over seventy such standard meridians are now in use by railroad and other companies throughout the United States and Canada; the larger towns and cities frequently adopt their own special local times, and the smaller ones adopt the railroad times most convenient to them; there are thus now in ordinary use at least 100 local times or meridians, many of them differing but a few minutes from each other.

Professor Barnard believes that a more thorough uniformity of accurate time would be to the daily advantage of all members of the community and all business transactions, and would immensely facilitate the study of certain natural phenomena, such as tornadoes, auroras, earthquakes, meteors, &c., for the observation of which we must depend largely upon those who chance to be favorably located.

It is accordingly proposed that the community unite upon a division of this continent into a few sections, throughout each of which the times adopted by railroad, canal, steamboat and telegraph companies, the city or town clocks and the clock makers, shall all be kept as nearly as possible in agreement with one standard meridian.

The system that especially commends itself for adoption, is that which also has the best prospect of being ultimately adopted by all nations throughout the world. It requires that, for the United States, we should adopt a central meridian in the Mississippi Valley, exactly 90° or six hours west of Greenwich, and proceed to the east or west by steps of exactly one hour each, so that the sectional times would be about as in the following schedule.

We have already given attention to this subject, and in "Science," Vol. I. p. 13, will be found some excellent suggestions in regard to "Uniform time," by Professor Ormond Stone.

In this article we merely present the views of Professor Barnard, the President of the American Metrological Society, and reserve a fuller consideration of the same for a future occasion. We may state, however, that we are heartily in accord with the object Professor Barnard has in view, and are pleased to find the matter in such able hands.

PROPOSED SCHEDULE OF STANDARD TIMES.

Geographical Section.	Standard Meridian west of Greenwich.	Standard Time slower than Greenwich.	Standard Time Slower or Faster than True "Local Times."	Designation of Proposed Standard Time.
Newfoundland, New Brunswick, Nova Scotia	60°	H. M. S. 4. 0. 0.	29 minutes slower than St. Johns, N. F.	Eastern Time.
			24 " faster than St. John, N. B.	
			14 " faster than Halifax, N. S.	
Canada, Maine to Florida, Ohio to Alabama, Lower Lakes.	75°	5. 0. 0.	15 " slower than Quebec	Atlantic Time.
			18 " faster than Toronto	
			16 " slower than Boston	
			3 " slower than New York	
			8 " faster than Washington	
			19 " faster than Charleston	
			45 " faster than Montgomery	
			14 " faster than Buffalo	
			30 " faster than Detroit	
			28 " faster than Cincinnati	
Mississippi Valley, Missouri Valley, Upper Lakes, Texas	90°	6. 0. 0.	0 " faster than New Orleans	Valley Time.
			1 " faster than St. Louis	
			12 " faster than St. Paul	
			18 " faster than Kansas City	
			19 " faster than Galveston	
			10 " slower than Chicago	
Rocky Mt. Region	105°	7. 0. 0.	0 " faster than Denver	Mountain Time.
			28 " faster than Salt Lake City	
Pacific States, British Columbia	120°	8. 0. 0.	12 " slower than San Diego	Pacific Time.
			10 " faster than San Francisco	
			11 " faster than Olympia	
			12 " faster than Victoria	

HOW TO OBTAIN THE BRAIN OF THE CAT.

Felis domestica.

BY PROFESSOR B. G. WILDER, M.D.

In the first number of "SCIENCE," under the title "A Bit of Summer Work," the writer suggested that teachers and students of the several sciences in which an acquaintance with the brain is required should try to gain some definite and personal knowledge of the organ by the preparation and dissection of the brain of the domestic cat.

The publication of the article was followed by numerous expressions of a desire to adopt the suggestion, but accompanied often by requests for reference to some work containing explicit directions as to the best methods of manipulation.

No such work is known to the writer. The "Dissector's Guides" and some general treatises on Human Anatomy give more or less complete instructions for the removal of the human brain: but the conditions are usually such that the most expert manipulator can hardly avoid some injury to the organ.[1]

For the removal of the brains of the lower mammals, no adequate directions have been published, so far as the writer is aware, although Chauveau enters (A, 716)[2] into some detail with regard to the horse's brain. Straus-Durckheim expressly states (B, 1, 321) that the method for animals is the same as that for the human subject, and the "Practical Physiology" (Foster & Langley, A, 215) contains merely the caution that "the brain of the dog or sheep should be removed from the skull as carefully as possible, especial pains being taken to cut the internal carotid arteries and the cranial nerves close to the skull,"

As guides to practical work for beginners in anatomy, the works just mentioned may, in respect to the brain, be likened to some "Manuals for Young Housekeepers," whose accomplished authors seem to realize neither the inexperience of their readers nor the possibility of conditions very different from their own, and whose teachings, therefore, prove ill-suited to the comprehension and the circumstances of those whom they desire to assist.

Now it is probable that few readers of "SCIENCE" have had the benefit of a full medical education, and it is certain that the anthropotomical method for the extraction of the brain does not answer for the removal of the brains of most other mammals. The skulls are usually so irregular in outline that the use of the saw is difficult and apt to do injury to the brain; moreover, at least for the purposes of preliminary study, the integrity of the brain should be ensured even when it involves the complete destruction of the skull.

The writer is therefore led to hope that the number of those who desire to obtain and dissect the brain of the cat is large enough to warrant the publication in "SCIENCE" of the directions which are followed by the students in the Anatomical Laboratory of Cornell University. Any criticisms or suggestions will be thankfully received. The method here described in detail is to be preferred when the brain is wanted entire, and especially when the length of the nerve roots is an object. The more expeditious methods which may be adopted under other conditions will be described hereafter.

INSTRUMENTS AND MATERIALS.—Medium scalpel;[3] sharp scalpel; arthrotome; tracer; curved scissors; bone-scissors; forceps; nippers; a cat's skull; large tray for the cat; small tray, or a folded cloth, for the head; block; small towel, or piece of muslin, for aiding the grasp of the head; paper for scraps; basin and towel; dish of 7 p.c. brine, about 6 cm. deep, and 20 wide, containing some well-soaked cotton; bowl of normal saline solution (15 grains of salt to 2000 cc. of water) sufficient to cover the head after its separation from the body; bowl for catching the blood; wide-mouthed jar or covered dish, of 60-70 p.c. alcohol, with some well-soaked cotton at the bottom.

Some of these items need explanation. The *arthrotome*—sometimes called "disarticulator"—is a short and strong double-edged scalpel, with a steel handle like that of the common "cartilage knife." The same use can be made of any short strong scapel ground down so as to have two edges of only moderate sharpness. Such an instrument saves the keener and thinner edges of the ordinary scalpels. The *tracer* looks something like the ordinary dental excavator, but its end tapers to a blunt point, which is so curved as to form about the quarter of a circle, and moderately sharpened on the concavity. This is used for tracing and isolating nerves and vessels, and is not only safer than the scalpel, but less liable to injury. Its cost is only 25 cents. The *bone-scissors* are simply a strong pair of curved scissors, employed for comparatively rough work. The ***nippers*** here referred to are the "diagonal side-cutting pliers" of the dealers in hardware. Instead of being parallel with the handles, as with most "bone-nippers," or at a right-angle therewith, as with the ordinary "cutting-pliers," the blades of these form with the handles a very open angle, confering upon the user an advantage similar to that which is gained by the employment of curved scissors. The nippers are to be had of seven sizes, from 10 to 20 cm., (4 to 8 inches) in length, and cost from 70 cents to $2.25, according to the size and the maker, those of Stubbs being the more expensive and highly finished. For use upon cats, those which are 5 inches long are to be preferred, and their points, if too wide, may be ground off.

The writer has been accustomed to use the nippers since 1872 for the removal of the brains of cats, dogs and young human subjects. It was not until after the year mentioned that he noted, in Flower's paper (3, 194), a remark as to "clipping away the skull from the brain of a monkey," the instrument, however, not being specified.

The nippers are equally applicable to living animals; with the rabbit, cat, and all but the larger dogs, the skull may be penetrated with them, and the opening easily enlarged to any extent desired. Perhaps the surgical "bone-forceps" have been employed for this purpose, but the "Hand-book for the Physiological Laboratory" (Sanderson, A, 305 and 418), directs that even so thin a skull as the rabbit's should be removed with the trephine and the scissors, and Dalton's recent paper (2) mentions only the trephine for exposing the brain of dogs.

Alcohol of the proper strength is readily prepared by adding 1 part of water to 2 parts of 95 p. c. alcohol. According to the size of the bowl or jar, the amounts may be 100 and 200, or 150 and 300 cc.

For the hardening and temporary preservation of the brain, the common deep finger-bowl is convenient. It may be covered with a piece of window-glass. Flat-bottomed dishes, with wide edges ground for the reception of covers, are made by Messrs. Whitall, Tatum & Co., of New York and Philadelphia, and the same firm have on hand wide-mouthed vials and specimen-jars of many sizes.

KILLING AND BLEEDING THE CAT.—When the brain is to be studied the animal should not be "pithed," on account of the injury to the medulla, and the settling of blood at the base of the organ. The cat may be drowned, but the following method is to be preferred as less distressing, more convenient, and permitting the evacuation of most of the blood. The *bleeding* may how-

[1] The writer has employed a modification of the ordinary method, and will take an early opportunity of submitting it to other anatomists.

[2] The system of references adopted in the present paper is the same as that described by the writer in No. 38 of this journal, p. 122, excepting that the numbers of papers published since 1873 are in smaller type than those of the papers which appeared prior to that date, and which are included in the "Royal Society Catalogue."

[3] Cases of dissecting instruments containing the arthrotome, tracer, scalpels of three sizes, curved scissors, forceps, fine-pointed forceps and curved scissors, and blow-pipe, are sold by Messrs. Codman & Shurtleff, of Boston, for $9.00. The nippers and bone-scissors must be obtained separately, as will be explained presently.

ever, be dispensed with. Put the cat in a close box, little larger than itself, and pour in 5 cc. of chloroform, or 20 cc. of ether. It usually becomes quiet in from 5 to 15 minutes. When touching the conjunctiva causes no winking, remove the cat to the large tray. Bring the head and neck nearly into line with the trunk. Part the hair upon the neck along a line between the angle of the mouth and the convexity of the shoulder. Along this line, divide the skin for 6—8 cm., opposite the larynx. This will either expose the *Vena jugularis* at once, or permit it to be seen when the borders of the skin are raised.

With the tracer, separate the vein from the adjoining parts for about 1 cm., and pass a bit of string entad * of it. Then turn the cat on the side, with the exposed vein over a bowl; the string makes it easier to pass the scalpel or blade of the scissors entad of the vein, which may then be cut. Let the blood flow into the bowl, occasionally lifting the body so that the blood may come more readily from the abdomen.

When the flow ceases, replace the cat in the box, with an additional 5 cc. of chloroform, or leave it upon the tray, and apply the chloroform upon a towel held very closely at the nostrils so as to prevent access of air. Death usually ensues in a few moments. If it be desired to ascertain the weight of the entire animal, the blood should be weighed.

If the more delicate internal parts or the microscopic structure are to be studied, the remaining operations for the procurement of the brain should be performed within 24 hours. But if the specimen is desired only for the fissures or the coarser anatomy, removal may be deferred for a week, provided the head be kept in a cool place. It should not, however, be allowed to freeze.

Separation of the skull.—Connect the angle of the mouth with the incision already made. If the sk n is to be mounted, this should be the only incision, and the skin must be dissected from the mandible as well as from the rest of the head. But if, as is more often the case, the skin is not to be preserved, while the muscles etc., of the neck are to be examined, make a corresponding incision from the angle of the mouth upon the opposite side.

In all subsequent operations, unless otherwise stated, both sides are to be treated alike.

Dissect the skin from the maxilla as far as the ventral margin of the orbit and cut the nasal cartilages. Dissect the skin from the nasal and frontal regions, including the upper and lower lids, but leaving the third lid, *Membrana nictitans*, attached to the ball. Remove the skin from the rest of the head, dividing the *meatus auditorius* close to the head. The *parotid gland* will be removed with the ear, but the *submaxillary*, of a darker color, will remain with the head. Reflect the skin from the cervical muscles for about 2 cm. caudad of the *crista lambdoidalis*.

Dissect the origin of the *M. massetericus* from the *zygoma*, noting that its cephalic and caudal borders are strengthened by tendinous bands which must be cut. Push a nipper-blade between the eyeball and the cephalic root of the zygoma, and nip the latter as close as possible to the maxilla. Then nip the caudal root at the angle between the transverse and longitudinal parts of the zygoma, just laterad of the *Fossa glenoidalis;* remove the zygoma with the bone-scissors.

Grasp the lateral aspect of the eyeball with the forceps, and rotate it mesad so as to expose its attachments, by the muscles and *N. opticus*, to the bottom of the orbit; cut the attachments with scissors, leaving the *Mb. nictitans* connected with the ball. If the eyes are to be studied or preserved, mark them right and left by numbers or tags; the proper position is always indicated by the *Mb. nictitans*.

Slightly ventriduct the mandible and move it from side to side so as to indicate the position of the *Ath. temporomandibulare*. Often the capsule has been opened already in nipping the caudal root of the zygoma. If not, it is to be cut while on the stretch by inserting the arthrotome, and cutting until separation is complete on that side.

Dissect the *M. temporalis* from its cranial origin, and then from its insertion upon the *processus coronalis* of the mandible. Then bring the mandible to a right angle with the rest of the head; feel for the caudal border of the hard palate, and for the tips of the *processus pterygoidei;* at a point midway between them push a scissor-blade entad of the soft palate, and divide it; then divide the mucosa forming the dorsal wall of the *postnares*, and dissect it from the basis cranii to the atlas.

The mandibles are now attached to the rest of the head by some muscles, by the mucosa at the angles of the mouth which may now be divided, and by the slender piers of the *hyoid arch*. These last join the skull at the lateral side of the bullæ, where they are to be divided with the arthrotome; if it be desired to examine the mode of their attachment, they may be cut with the bone-scissors at a little distance from the attachment.

Turn the tip of the mandible still farther ventrad and caudad, and dissect off the muscular masses that are inserted between the bullæ; near the caudal ends of the mesal borders of the bullæ emerge several nerves, which should be divided with the scissors or a sharp scalpel at about 1 cm. from the skull. By continuing the removal of the muscles across the *Ath. atlo-occipitale* this is exposed. Put the membranes upon the stretch, and divide them with a sharp scalpel along the cephalic border of the atlas. This exposes the *myelon*, which is to be divided in the same way. The remaining ligaments and the cervical muscles may be cut with the arthrotome and the skull proper is then separated from the rest of the body. Place the skull in the *n. s. s.*, and wash the hands and the instruments which have been used.

EXPOSURE OF THE BRAIN.—The method here described is by successly removing bits of the skull with the nippers.

Caution.—In the later stages of the operation there is considerable risk of injuring the brain by the unintentional pressure of the nippers. In whatever way the bone is grasped, when force is applied, the tendency is to approximate the cutting edges as nearly as possible, and thus to bring their planes into right angles with the surface of the bone. This of course crowds the convexity of the ental blade against the brain, and may crush it seriously. It may occur either from the turning of the nippers in the hand, or more frequently from the escape of the skull from the grasp of the other hand. The accidents may usually be avoided by keeping the matter in mind, by having the right hand dry, and aiding the grasp of the more or less slippery skull by a small towel or bit of coarse muslin; this last is also desirable during some stages of the operation as a protection of the hand itself from abrasion.

In using the nippers another precaution is to be observed. If the bit of bone to be removed is attached only to bone it may be either cut or broken, or twisted off; but if it adheres to the *dura* or other soft parts, only *cutting* should be employed, and that done with care.

During the exposure of the brain the head should be frequently dipped into the *n. s. s.* If obliged to suspend the operation for more than an hour, wrap the head in a cloth wet with the *n.s. s.*, and set in a cool place.

Nip off the caudal root of the zygoma, including the *Fs. glenoidalis.* Insert a nipper-blade into the *meatus auditorius*, and remove the bulla in fragments. With the scissors cut away the membranes attached to the margin of the *Fm. magnum*. Nip off the occipital condyles, with the intervening area of the *basioccipital* for 2-3 mm.

* The meaning of this and some other unfamiliar terms may be learned from a paper (9) in "SCIENCE" for March 19 and 26. Most of the words employed are to be found in a Human Anatomy, or a dictionary, general or medical.

from the foramen. Insert a nipper-blade between the dura and the bone 5–6 mm. from the meson and in line with the mesal border of the cephalic part of the bulla, and nip out the basioccipital as far as the middle of the length of the bulla. At or near the angle left after the removal of the condyle and the basioccipital, the *N. hypoglossalis* enters the *Fm. condylare*, and passes cephalad to emerge on the ventral aspect of the skull by the *Fm. jugulare*. If the series of roots do not appear, carefully remove a little more bone until they do. If the nerve-roots are to be especially studied, endeavor to nip off the bone surrounding the *Fm. condylare*, so as to save the trunk. On emerging upon the ventral aspect of the skull, the *N. hypoglossalis* will be found to lie practically in the *Fm. jugulare*, and to be more or less intimately attached to the *NN. glossopharyngealis, vagus* and *accessorius*, which penetrate the bone by that foramen. In attempting to separate the *N. hyp.* great care must be used to avoid any traction upon the roots, which readily pull out of the medulla. Of the other three nerves, the *accessorius* is the most caudal, and the most readily distinguished, but at this stage it is as well to leave them together, simply endeavoring to remove the bone surrounding the foramen, and to save the trunks pretty long, at least upon one side. Upon the other, it will save time to cut the roots just entad of the skull, and the same may be done on one side with the remaining nerves, or with all upon both sides in case the brain is not to be employed for the study of the apparent nerve-origins.

The dorsal wall of the bulla is hard, but readily crumbles between the nippers. It may be removed in small pieces, so as to save the *NN. facialis* and *auditorius* which enter the *Fm. auditorium internum*, and the little *Lobulus appendicularis* of the cerebellum which is lodged in a slight fossa just dorsad of the foramen.

Since no nerves are transmitted by the mesal region of the basis cranii, it may be removed with comparative freedom, as far cephalad as the *pituitary fossa* where some care is needed to avoid injuring the *hypophysis*.

The skull may now be held more securely by the facial region, especially if a towel is employed. In removing the bone at each side of the meson, and just cephalad of the bullæ, great care is required to disengage the nerves which emerge by the *FF. ovale, rotundum*, and *sphenoidale*. These nerves, the *NN. oculomotorius, trochlearis*, and *abducens*, with the *ophthalmic, superior maxillary*, and *inferior maxillary* divisions of the *N. trigeminus*, penetrate the bone more or less obliquely, and are closely surrounded by dense connective tissue.

Just cephalad of this series of foramina is the *F. opticum*, and the *N. opticus* is particularly hard to disengage without tearing some of the delicate parts (*terma*, or *lamina terminalis*, etc.,) which are connected with the *chiasma*. Since the optic nerves are always easily recognized, it is usually better to cut them pretty short with the scissors, than to run the risk of rupturing the terma.

The entire maxilla is now to be removed by first nipping the interorbital region just cephalad of the fronto-maxillary suture, and then, with the bone-scissors, cutting toward this point from just caudad of the cephalic root of the zygoma. The scissors should be kept as far cephalad as possible, so that the *Bulbi olfactorii* may not be injured. This plan serves equally well for some dogs, but with the larger breeds, which have prominent *bulbi olf.* the interorbital region should be nipped at about the middle of the length of the nasal bones.

Remove the mesal walls of the orbit, and the turbinated bones, using care not to crush the very soft *Bulbi olf.* The *Nervi olf.* should be divided, a few at a time, with the scissors or the tip of the scalpel, and all pulling and twisting of the parts must be avoided.

During the remaining steps of the operation, the head must be held by the parietal regions, and with great care, so as to avoid pressure of the tips of the fingers upon the brain. The bone, also, must now be *cut* by the nippers rather than twisted or broken. Nip off the *supraoccipitale*, including the dura, as far as the *Crista lambdoidalis*. To remove the ventral part of the bony tentorium, introduce a nipper-blade between it and the hemisphere on either side, in such a way that the greater convexity is toward the hemisphere rather than the cerebellum; the cut is to be made at the level of the *Sutura squamosa;* the width of the tentorium at this point is about 8 mm., and the nipper-blade should not be introduced to a greater depth than that, for fear of injuring the *Lobi optici*. In closing the blades the head should be held very firmly so that no rotation may occur. The detached ventral piece of the tentorium may be extracted by the forceps, or by the nippers used as forceps, any adhesions being carefully separated with the tracer or scissors.

Hold the head with the ventral side down, support the caudal divisions of the brain with a disengaged finger, and with tracer and scissors separate the cephalic surface of the cerebellum from the tentorium. Then hold the head with its caudal end down, and complete the disengagement of the *Bulbi olf.* Hold the head over the 7 p. c. brine, with the ventral side down, and nip out, piecemeal, a triangular piece of the calvaria, nearly to the tentorium. The mesal adhesions of the dura may be divided with the scissors, but elsewhere the dura is to be left upon the hemispheres. As the hemispheres begin to fall, hold the head so that they are supported by the brine, and then snip all remaining adhesions until the entire brain is free and floats in the liquid.

REMOVAL OF THE DURA.—Saturate some cotton with the brine, and place it under the brain, so that about one-third of the organ projects above the surface. Avoid handling and lifting the brain; move it by shifting the cotton, or by grasping the dorsal portions of the dura. Remove the dorsal and lateral parts of the dura by grasping the free borders left by cutting along the dorsimeson, and cutting out piece by piece with the scissors. Then grasp the *falx* just dorso-caudad of the *Bulbi olf.*, at the straight transverse fissure—*F. cruciata;* introduce the scissors about 5 mm., and cut the *falx*. Gently draw the cephalic portion cephalo-ventrad between the *Bulbi olf.*, and remove it. Draw the caudal portion caudad, and carefully cut all its attachments.

Turn the brain upon its dorsal surface, and remove the ventral portions of the dura with great care and in small pieces. Especial pains are needed in connection with the hypophysis and the nerves, and all pulling must be avoided. On one side, at least, it is well to leave the dura still attached to the nerves and the great *Gasserian ganglion* upon the *N. trigeminus*, to be more completely removed at the time of the removal of the pia.

TRANSFER TO THE ALCOHOL.—Place a large spoon or watch-glass at the side of the brain, and pull the cotton which supports it, so as to roll it into the glass, resting upon its dorsum. Let the brain slide off into the alcohol so as to rest on the cotton therein, still with the ventral side up.

Set the bowl with the alcohol in a cool place, and change the position of the brain at intervals of five to ten hours during the first three days, by pulling the cotton in various directions. At the end of about three days, transfer the brain to 95 p. c. alcohol, where it may remain indefinitely. For a few days, however, it should rest upon cotton, and its position be occasionally changed.

WEIGHING THE BRAIN.—If this is to be done, handling the brain may be avoided as follows; Place the bowl of alcohol into which the brain is to be put, upon the scales, and pour in alcohol of the same strength until it balances an even number of grams, *e. g.*, 400, 410, or 420. While the brain is in the spoon or watch-glass, pour over it some of the same alcohol, and then let the latter drain off as much as possible, by tilting the glass.

and supporting the brain with the fingers or a bit of cotton. Then transfer to the bowl of alcohol as above directed, and the increase in weight will represent, with approximate accuracy, the weight of the brain.

REMOVAL OF THE PIA.—This is most easily accomplished at the time of the removal of the brain to the stronger alcohol. At any subsequent period the pia is apt to be more firmly adherent. If the brain has been allowed to dry at all during its removal from the skull, the pia comes off with great difficulty.

Instruments and materials.—Forceps; fine forceps; medium scissors; wetting-bottle of 15 p. c. glycerine; cotton thoroughly wet with water, and so moulded as to form a sort of shallow cup in which the brain may rest without danger of rolling off.

Place the brain upon the cotton, and wet it with the glycerine. Then let it rest upon its ventral side, and grasp it in the cotton, firmly yet gently. Grasp with the forceps the fold of *pia* which occupies any one of the fissures, especially at the point of forking or junction with another fissure, and pull along the line of the fissure. Usually the fold of pia will come out easily, and with it will be removed some of the pia covering the free surface of the gyri between it and the adjoining fissures. Proceed thus until the pia has been removed from the dorsal and lateral aspects of the hemispheres. Avoid pulling across the line of the fissures. The larger forceps are easier to work with, and less apt to puncture the brain; but the fine forceps are sometimes required for the removal of the pia from the bottom of a deep fissure. The caudal surface of the hemispheres may be reached by slightly ventriducting the cerebellum. The mesal pia can only be removed close to the margins of the hemispheres.

On one side, preferably that on which the *N. opticus* was cut shorter, raise the mass of nerves formed by the divisions of the *N. trigeminus* and *N. abducens*, by its lateral border, and cut with the scissors the *N. oculomotorius* which holds the mesial border close to the brain. This will permit the mass to be turned caudad so as to expose the course of the slender *N. trochlearis* which emerges from between the hemispheres and the cerebellum. It also permits the removal of the pia from the region just laterad of the hypophysis. Grasp the pia on the ventrimeson just caudad of the *Bulbi olf.*, and pull caudad so as to remove it as far as the chiasma, taking care not to tear the delicate *terma* just dorsad of the chiasma. Then remove the pia from the olfactory tracts.

In removing the pia from the medulla the position of the nerve roots should be constantly kept in mind, and the traction should be laterad and cephalad. One of the most difficult things is to preserve uninjured the series of roots of the *N. hypoglossalis*, for their connection with the pia seems to be closer than with the medulla. Sometimes it may be necessary to let the brain be wholly below the surface of water or alcohol so as to float the roots out, and render them more apparent.

As suggested on a previous page, it is often as well to leave the roots longer on one side than the other, but the choice may be determined mainly by the degree of success in the various operations which have been described.

If desired, later numbers of "SCIENCE" will contain directions for the general dissection of the brain. Meantime, it would be well for the student to make outline drawings of the brain he has prepared, especially of its base. Most of the principal features of this surface can be identified from the figure of the corresponding surface of the human brain to be found in any good Human Anatomy. The drawing should be enlarged two diameters, and the brain should be kept wet with the glycerine mixture, while it is out of the alcohol.

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ATOMS AND MONADS, THEIR METAPHYSICAL DEVELOPMENT.

BY DR. DIODATO BORRELLI.

(Translated from the Italian by the Marchioness Clara Lanza.)

In previous chapters of this work [1] it has been shown that the whole product of our psychological activity typifies a purely metaphysical world. It has likewise been seen, that the vast compound of forms by means of which exterior nature is represented to us, is not an extrinsic reality, but merely our own impressions, the result of slow and unconscious practice. A minute physio-psychological analysis leads us to this necessary conclusion. Colors are mere modifications, induced in certain groups of ganglion and cephalic cells by a stimulus which acts upon the organs of sight. Sounds are another form of cellular modification determined by a different kind of stimulus. Weight and resistance are phenomena of muscular sense. Form and size, synthetic relations, and therefore purely subjective phenomena. All the complex qualities by means of which physics are able to recognize different bodies, are nothing more than our own determinations. From this we may properly conclude that body and matter are not extrinsic realities, but a complication of modifications produced within us by exterior impulses.

Our world is therefore purely phenomenal, and not a reality. Herbart reasonably maintains that the first moment of research must necessarily be one of doubt, or scepticism, which is degraded or elevated in proportion as the uncertainty concerns things as they seem to us, or whether it relates to existence itself. Does the reality exist? This is the first question which presents itself to the philosopher. And if it does exist, what constitutes it and the consecutive research? "We cannot deny the reality," says Herbart, "because, to do so, is to remove all possibillity of the phenomenal world before mentioned. Sensations, representations and thoughts would be completely annulled."

This phenomenal world, resulting from the data of experience, is that which induces us to admit the existence of positivism. But these data do not constitute real existence, because they are not self-subsisting, but depend upon something else. That is to say, they exist in something else and by means of something else. *Actual existence* does not admit of either relation or dependence, it is based upon itself, and is, therefore, an absolute con-

[1] Borrelli. *Vita E Natura. Studii sui temi più importanti del Moderno Naturalismo.* Naples, 1880.

dition to the full comprehension of which we cannot attain, although we cannot fail to recognize it. The positive is, therefore, something to which this absolute existence attaches itself—it is in fact, a quality.

According to Spencer,[2] positiveness is nothing more than *persistence in the consciousness;* "unconditional persistence, such as the mental perception of space, or conditional, such as the intuition of a body we hold in the hand. That which establishes the persistence is really what we call positiveness, of which, (although we have demonstrated that the positive within our own consciousnsss is not objective) we, nevertheless, form an indefinite idea as being something which persists absolutely, in spite of all change of mode, form or appearance."

Spencer's definition, however, is in some respects open to criticism. First of all, if by consciousness, individual consciousness is to be understood, can anything persist which is merely an illusion without any definite existence? This can only happen under certain pathological conditionns of the mind. But there is still another point. Persistence in the consciousness is certainly a relation, because no thought can be produced without a relation, and even Spencer affirms this when he says; "We think relatively, every thought is based upon a relation."

However, according to Herbart, one of the principal conditions of absolute reality, is to be free from everything pertaining to dependence or relation. To avoid confusion, we must give more than one signification to the word positiveness. To begin with, we cannot ignore a *relative positiveness* which comprises all the conscious conditions of our being, and the famous sentence "*cogito, ergo sum*," is in itself a peremptory demonstration of it. Sensations, representations, sentiments and all other familiar modifications are embodied in such positiveness. Whether they correspond to an objective effect or not: whether they are illusions of a diseased mind, or normal representations, is of little consequence. We know that they exist in our consciousness, and that is sufficient, inasmuch as they typify a real function.

We cannot say as much for objective or absolute positiveness. In regard to this, the experience of our senses teaches us nothing. We only know that it does not correspond to our individual sensations and that it differs from them essentially. In all our relations with the exterior world there is nevertheless a common and constant condition—an inexplicable something which acts upon our organs of sense and determnes the inward modifications. If, however, we rob Nature of our complex determinations, we leave nothing remaining but *stimulus* or *action*, which works upon us incessantly. The idea of objective or cosmic positiveness, originating from the da'a of experience, presents to us a conception of force or energy, combined with continual action. Absolute positiveness we can only understand as something corresponding to *permanent acitvity*.

The most ancient philosophers of Greece and India made extensive speculations as to what this natural force or activity might be, which operates in such manifold ways upon our senses and creates in us the most stupendous and varied phenomena. Indeed, human reason in Ionian, Pythagorean and Eleatic schools, seems to have been directed solely upon Nature under its various aspects.

According to Thales, water is the first general principle from which all other things are derived. In Anaximander of Miletus, a more condensed cosmological conception appears concerning the universe as being constructed out of *primitive matter*, which he called fundamental principle—an eternal, infinite, indefinite basis, from which everything originates and to which everything in the course of time, returns. This principle is not, as Aristotle appears to think, a compound which upon separation resolves itself later into particular forms. It seems easier to believe that the specification could only occur under some peculiar influence.[3]

We may well be astonished when we consider that six centuries ago a conception concerning the universe arose, which intimately resembles our modern cosmology. And our wonder is increased ten-fold when we see Anaximander produce from his fundamental principle the original antithesis of heat and cold by means of an inherent and eternal movement of the substance.[4]

According to Anaximanes, *Air* is the first general principle from which everything is produced by means of the double process of condensation and rarefaction. This theory should not appear strange to our modern mechanical school, according to which, particular forms of ethereal atoms are diffused throughout sidereal space, from which chemical atoms, and, consequently, all ulterior bodies are produced.

While the Ionian school deals principally with the sensible qualities of bodies, it aims more directly towards their inward substance. But we see in that of Pythagoras a new tendency, an increased abstraction. Paying but little attention to Nature, which is unknown to existence, he turns to consider order and quality, which are, indeed, realities. Numbers are the principle of all things; the Universe is only measure and harmony. Our quantitative relations, dimension, extension, form, distance, etc., are impossible without the aid of numbers, and therefore numbers are the first principle in all things, as they determine the order in which everything presents itself. Without stopping to discuss with Zeller as to whether the Pythagorean numbers are the substance or model of sensible things, we must particularly note that the idea of order and numbers is chiefly important in our modern conception of the Universe. If Nature really consists of but a single substance of various formations from whose elementary parts the specification of individual bodies is produced, it is natural to suppose that the true essence of all things by which they are determined, cannot be the indefinite cosmic principle, but a special disposition, which assumes its elements and the number in which they unite. *Numbers and disposition* form, as we shall see, the basis upon which modern chemistry rests.

With the Eleatic school which arose from a conception of *unity* and *immovability*, exaggerated to such an extent as to lead Zeno to a paradoxical denial of all motion, we come to Heraclitus, who, in direct opposition to the Eleatic school, speaks of perpetual flux and movement. The permanence of existence is merely an illusion. Positiveness may be compared to a river which disappears as it rises, and into whose waters, consequently, we can plunge but once. Heraclitus affirms that nothing remains equal to itself, that everything increases, diminishes, and finally dissolving, passes into other forms. Hence, from life to death, and from death to life again. The appearance and disappearance of these forms is, therefore, the perpetual vicissitude of the universe. In this stupendous doctrine we have the conception of future existence, which is nothing more than the harmonious blending of adverse tendencies. And in it we think to perceive the germs of the future theory of evolution. But it contains something else also. According to Heraclitus *fire* symbolizes the law of vicissitude. This is a profound doctrine which demonstrates to modern theories that no new formation or division of elementary bodies is possible without a corresponding modification in the inward action from which thermal phenomena are derived.

In the four roots of all things—fire, air, water and earth—there is first of all connection with the *sphere* and later a division. Upon this blending and separation depends the source and dissolution of all particular forms.

[2] Herbert Spencer. *First Principles*. 1871.

[3] Zeller, quoted by Fiorentino. *Manuale di Storia della Filosofia*, Naples, 1879.

[4] Schwegler. *Geschichte der philosophie*.

In Empedocles we find for the first time a confused perception of *attraction* and *resistance* in the sympathy and conflict which are the determining causes of the union and disunion of the elements.

Up to this time we have an irreconcilable antithesis between the Eleatic conception and that of Heraclitus. On one side, by exceeding the data of experience and elevating to the highest degree abstracts of material things, we find existence robbed of all determination and unchangeable. On the other, we have existence and non-existence bound together by means of the Future, from which springs the change and perpetual vicissitude of all things. But there is no fixed law for the Future of Heraclitus; it is merely the result of experience, nothing more. Why, therefore, does existence change? Why are forms produced only to be again dissolved into something else? An attempted explanation was given, as we have seen by Empedocles; sympathy and resistance attract and repulse the four radicals of all things, and all forms are produced by the attraction which the repulsion afterward disunites and destroys. This is a profound conception, but yet somewhat obscure and undecided.

It was the *Atomical* school which took gigantic strides along this path, finally reaching those massive theories which even to-day we must look upon with admiration. Its founders were Lucippus and Democritus, but the latter is undoubtedly the most celebrated. We will go over the most important points in his doctrine, as they are related by Fiorentino.

"Existence is not a unity, but a combination and an infinite one, composed of many minute and invisible bodies which move about in space, unite and produce life, then separate, and cause death. They are capable of union and disunion, but never of change, and just as they are in the beginning, so they will always remain.

"We can distinguish in atoms form, order and position which are the primitive qualities which serve to produce others. All atoms are not equal; all have a downward tendency, but the lighter rise above the heavier producing a rotatory motion which extends and forms bodies."

Atoms, moreover, are impenetrable, and as units cannot be divided. They are consequently distinct one from the other, well defined and unconfused. This necessitates the interposition of something which tends to keep them separate. It can be nothing more than the *opposite* of the mass, vacuum, which causes interceding intervals between the atoms and holds them apart. Without vacuum, no motion could be possible, as the mass can receive nothing more in itself, or be augmented in any way, because this can only be obtained by the introduction of new atoms in the vacuum. We have, therefore, two contending agencies—existence (atoms) and non-existence (space), which go to represent objective positiveness. The final and most important of atomic theories bears the stamp of unconscious and unintelligible *natural necessity*. Motion can be determined by no cause. It is as eternal as the atom itself and is a part of its nature. It is easy to understand therefore, however far it may depart from the truth, the opinion of those followers of Democritus who attribute the origin of the world to chance.

By the atomical theory we have reconciled therefore, the unchangeableness of existence with the perpetual transformation of things; transformations which have nothing to do with the substance, but which spring from special arrangements of the atoms determined by motion. We shall shortly see how the fundamental doctrines of the atomical school have been reproduced in our modern mechanical one after a lapse of four centuries.

The Grecian mind was not satisfied with the mechanical explanation of future existence. We consequently see brought to light for the first time by Anaxagoras, an immaterial principle *Nous*—an intelligence apart from all matter, maker of the world. In short, an agent with a definite purpose. This intelligence, although motionless itself, is the cause of movement, and the formation of the *panspermia* or *omeomeria*, as Aristotle calls it, is the result of its action. This is the systematic and beautiful origin of the world.[5]

This intelligence, however, is not a personal god, because it possesses no action in itself and its operation develops solely in the motion and order of matter. Plato and Aristotle are quite right when they blame Anaxagoras for holding to the mechanical doctrine while having an instinctive perception of the final cause.

The *Nous* of Anaxagoras, as Schwegler has observed, closes the period of anti-Socratic realism, that is to say the conception of natural positiveness as represented by ancient Grecian philosophy. Anaxagoras embraced the principles belonging to the preceding schools which he attempted to reconcile, but he made apparent for the first time an *ideal* principle, which being accepted by Socrates, afterwards expressed the new and adverse current of Grecian thought.

Atomism reappeared with Epicurus, not presenting, however, any novel determination, except that the atoms did not all descend in a direct line giving rise to a whirling motion, as Democritus affirms, but proceeded each separately in its own way guided by a kind of free will.

Throughout the long period of ideal speculation which succeeded ancient Grecian philosophy, investigation in regard to cosmic positiveness being looked upon as a matter of secondary importance or else neglected altogether, naturally made no progress whatever Thus we come to the Sixteenth century, during which a single voice in England was raised to deplore the false road upon which human thought had traveled for so long, agitated and confused by empty and useless discussions. Logic seemed to aim towards the "strengthening of error rather than the search for truth." "And this," said Bacon, "can proceed from nothing but the fact that scientific research is alienated from its true source—nature and experience—to which it must return if anything is to be achieved." Although many errors crept into the facts accumulated by Bacon among his perceptions of great truths, he, nevertheless, rendered an immense service to science by recalling it to experiment and to the inductive method. About the same time, a great Italian, Galileo, not only proclaimed the system, but applied it, gathering much more fruit from his enterprise than did the English philosopher.

This was one of the grandest moments known to the human mind. In this period, which we call the Renaissance, while man, no longer satisfied with the narrow boundaries of the old world, discovered new paths while in search of other lands, human conscience oppressed by centuries of overbearing slavery advanced towards reformation. Then speculation, shattering its scholastic fetters, opened a new field for research, and resolved to cultivate it by fresh methods. Later we shall see the abundant fruit which grew, not so much from the field of abstract speculation as from that of natural investigation.

René des Cartes here broke in with past traditions, endeavored to make the research over again from the beginning, and commenced to exclude all supposition and to entertain doubts about everything. But the new structure of facts which he built upon Thought was precisely the contrary of his method. Positiveness according to des Cartes is represented by three substances—God, Mind and Matter. Thought is the attribute and essence of mind; extension is the attribute of matter. Here, then, is cosmic positiveness reduced to nothing more than *expanse*, while in our opinion it is the very opposite. Expanse is merely a relation, and it annuls the absolute condition of existence reducing it to a simple *rapport*.

[5] The panspermic theory affirms that the germs or elements of all things exist in the earth, and only require a particular combination of circumstances to bring them forth.—TRANSLATOR.

In the monadology of Leibnitz, we find a reversion to atomism under an ideal form. He considers the substance of the universe as an active force, represented by monads. These, after the manner of atoms, are a distinct unity, unchangeable and indestructible. Contrary, however, to atoms, which do not present any qualifying diversity in themselves, monads are distinguishable one from the other, each one personating, as it were, a distinct form. Moreover, atoms being capable of expansion, can be regarded as separable, but monads cannot, because they are metaphysical conditions. And inasmuch as metaphysical conditions, no matter how they unite, can never go beyond a certain limit, Leibnitz denies the objective reality of space, and looks upon it as a kind of co-existence.

But the most important part of his doctrine is the conception he places upon the action of monads. Each one has its peculiar representation apart from the other monads and consequently, the universe. All the ulterior developments of the latter are therein portrayed, so that in monads we may read the future. Such representative power is not the same in all of them, however. Some, monads of the lowest degree, have a confused representation which may be compared to vertigo or dreamless sleep; a condition in which representations are not wanting, but being neutralized cannot attain consciousness. These lower orders of monads represent the first link belonging to the chain of existence, which is called inorganic nature, and the bodies resulting from them may be likened to a fish pond whose elements are alive while it is not.

Occupying a higher grade, in the vegetable kingdom, are monads in which representation acts as a formative vital force, but always totally unconscious. Higher still, in the animal world, monad life rises to sensations and memory, and finally to reason and reflex action. However, let us repeat, in order that it may be well understood, that the representative contents of the various orders of monads do not differ, because each one, like God, reflects the entire universe *(parvo in suo genere deus)*. The difference lies solely in the clearness and perfection of the representations.

We will not linger here, however, that we may slowly follow the ideas of Leibnitz in regard to the relations existing between God and monads, or between them and the soul by means of pre-established harmony. We will merely observe that if we remove from monadology all the purely imaginary elements with which it overflows, there still remains something both novel and important which is not to be met with in old atomical theories. This novel determination consists in a peculiar active force which each monad possesses *internally*. It is a prior intuition of *pampsichism* which being enriched moreover by positive facts, can lead the way perhaps, to the greatest reconciliation of which the human mind is capable.

We find another reversion to atomism in the metaphysics of John Frederick Herbart. We have already seen his conception of absolute positiveness. However, experience receives many suggestions from the phenomenal world, which is composed of manifold appearances. And as every appearance insinuates a determined Reality, the latter must be considered as a compound of several single entities or monads, each one posessing different qualities. The individual groups of these monads are those which, working upon our senses, there produce the representation of definite objects. We find a vast difference between Herbart's conception and that of Hegel; while the former considers Nature as a plurality, the latter conceives it to be a unity. To one, absolute positiveness is the Ideal, while for the other, on the contrary, it is Reality.

But how can we reconcile the absolute condition of the Real, the peculiar conservation of monads with the phenomenon of mutation. Herbart has recourse to *accidental perceptions* and *intelligible space*. By accidental perceptions, we mean the manifold relations which can proceed from a single conception, according as it may be compared with others, but, nevertheless, remaining always unchanged. Thus, for example, a straight line can be considered as a radius or as a tangent without changing its position, just as a sound can be harmonious or discordant, according to the relation it bears towards other tones. In the same way, in the grouping of various qualities of monads, while on one side there is no change, on the other there is a very perceptible one. By means of *intelligible space* we may consider existence either as a complex form or as an individuality.

This theory, which in some ways closely resembles the old atomic dogma, is far removed from it, inasmuch as the monad or atom, according to Herbart, does not possess an impenetrable character.

Looked at from a mathematical point of view, several monads may coincide perfectly one with the other. Between the monad of Leibnitz and that of Herbart, there is also a noteworthy difference, because the former considers the *internal condition* as original and individual; while with the latter it is wanting, if we consider a single monad, but develops with the reciprocal relations between the monads.

We will finish with Herbart, our brief explanation of atomism revealed upon a field of pure metaphysical speculation. On the other hand, a new doctrine arises, an experimental one, from which we shall see produced an atomic theory, which is not the work of more or less arbitrary deductions, but the slow result and synthesis of a multitude of positive facts.

ASTRONOMY.

SPECTRUM OF "LALANDE 13412."

We are indebted to Prof. Pickering for the following note upon some observations recently made at Harvard College Observatory:

"The star *Lalande* 13412 has a very curious spectrum. It belongs to the same class as *Oeltzen* 17681 and the three stars in *Cygnus* having bright lines. Besides the yellow and blue bands, it has a marked line in the green, which is faint, if not wanting, in the other stars. It is also about a magnitude brighter than either of them, so that it is the only object of the kind within reach of small telescopes. Professor Young found *Oeltzen* 17681 difficult with 9-inches aperture, while I discovered this object with 4-inches aperture. The position for 1880 is:

R. A. 6^h. 49.3^m.
Dec. —23° 47.′

or about 15′ north of *o Canis Majoris*. In winter this star is conveniently observed when all the other stars of this class are below the horizon.

The same evening I found that the spectrum of a^2 *Puppis* is banded. As the declination of this star is —44½°, this is probably the most southern object ever usefully observed here. Its altitude at the time of observation was only about 2°!"

The Transit of Venus Commission established by the French Academy of Sciences, has resumed its labors under the presidency of M. Dumas. A credit has been given by the Government for constructing new refractors. Not less than twelve are now building, to be used on the several stations which have been already selected, and will be ready by the end of the year. The heads of the scientific missions will soon be appointed, as well as their staff. The greater number of instruments built for the 1874 transit has been disposed of to several public institutions.—*Nature*.

W. C. W.

WASHINGTON, D. C., April 6, 1881.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

To the Editor of "SCIENCE:"

It is with mingled pleasure and profit that I have read the very suggestive paper on cerebral nomenclature contributed to your latest issues by Professor Wilder[1]. Some of the suggestions which he has made have been latent in my own mind for years, but I have lacked the courage to bring them before my colleagues. Now that he has broken ground, those who prefer a rational nomenclature to one which like the *present* reigning one, is based upon erroneous principles, or rather on no principles at all, will be rejoiced at the precedent thus set for innovations. As Professor Wilder has invited criticism, I take the opportunity of offering the following remarks upon the leading points of his papers, in so far as they refer to the brain alone.

1. The principles announced are such as zootomists and anatomists generally will agree with, to the fullest extent. He who has himself been compelled to labor under the curse of the old system, the "beneath," "below," "under," "in front of," "inside," "external," "between," etc., of anatomy, as taught at our graduating mills, will look upon the simple "ventral" "dorsal," "lateral," "mesal," "cephalic," (or "nasal" or "proximal") and "caudal" ("distal") as so many boons. I have no hesitation in saying that the labor of the anatomical student will be diminished fully one-half when this nomenclature shall have been definitely adopted. I suppose, however, that the present generation of teachers—I am speaking of our medical schools, not of our universities—will have to become extinct before even the attempt can be made. In Germany the older system has gone out of use almost entirely, and not the least charm about the works of Henle, Schwalbe, Forel, and Gudden, is the fact that these authors have more or less done away with the ambiguous terms once rampant.

2. At present two terms are used convertibly; these are *crus* and *pedunculus*. The chief parts to which these terms are given are the *crus cerebri* (*pedunculus cerebri*) and the *pedunculi cerebelli* (*crura cerebelli*). If anatomists would agree to use the term *crus* only for the cerebral tract, and *pedunculus* for the cerebellar, it would save us the necessity of adding another word. *Crus* would mean what *crus* or *pedunculus cerebri* now designates, *pedunculus* a cerebellar tract. The modifications suggested by Professor Wilder of *præpedunculus*, etc., are excellent. The word *pedunculus* has been applied to a number of other structures, but, I think, inappropriately; thus, *pedunculus conarii*, *pedunculus hypophyseos pedunculus flocculi*, *pedunculus nuclei lenticularis*, *pedunculus substantiæ nigræ*, from all of which it should be removed, as there are other terms in use for these structures, or they are non-descriptive, as the latter two given.

3. In proceeding to comment on some of the terms proposed by Professor Wilder, I wish it to be distinctly understood that I do so merely tentatively and to promote discussion; in so doing I feel certain that I am carrying out that writer's wish. It is but just to state that the majority of the terms cannot be discussed, they are perfection and simplicity combined.

AMYGDALA (*Cerebelli*), W.—Since there is a *nucleus amygdalæ* in the temporal lobe of the cerebrum of man, simians and carnivores, which should be called *amygdala* briefly, just as the *nucleus lenticularis* and *n. caudatus* are termed *lenticularis* and *caudatus* and as the synonym *tonsilla cerebelli*[2] is at our disposal for the similarly named lobule of the cerebellum, I suggest replacing this term as applied to the cerebellum by *tonsilla*.

AREA INTERCRURALIS, W.—I have this term in a manuscript of mine, and am glad to find such a coincidence in baptism, according the priority, of course, to the first publication. I bound this area cephalad by the caudal border of the chiasm, caudad by the cephalic border of the Pons, laterad by the crura, and distinguish the deeper part as a *fossa intercruralis* (*substantia perforata post.*) The gray mass here located is the ventral face of Gudden's[3, 4] interpeduncular ganglion, which I propose, in order to secure nomenclatural uniformity, to term (*Ganglion*) *intercrurale*.

AREA POSTPONTILIS, W.—The objection can be made that this area is not homologous in different animals. A large part of the true Pons in man includes the portion homologous with a part of the *Area postpontilis* of the cat. The roots of the abducens nerve (6th pair) seem to me to constitute a more fixed boundary.

CAUDA STRIATI, W.—I have identified this structure in the cat; it does not make as fine a sweep as in man, but is distinct at the roof of the inferior horn and loses itself as has long been known[5] in the case of the human brain near the *Nucleus amygdalæ*. Professor Wilder's term is the only admissable one, both as being descriptive and on grounds of priority. *Cingulum* is otherwise appropriated.

CONARIUM, W.—Would not the retaining of this name deprive us of that convenient antithesis which can be established between *epiphysis diencephali* and *hypophysis diencephali*?

DENTATUM, W.—Some term should be devised which will at the same time express the fact that this gray mass is a nucleus of the cerebellum and differentiate it from the *nucleus fastigii* (*fastigialis*). *Dentatum* is not appropriate, in my judgment, because in those animals in which it is dentated, there are other dentated nuclei, and also because it is not dentated at all in the rodentia, the carnivora, and ungulata.

EPENCEPHALON.—Are there any reasons why a seperate segment of this name should be made? Some authors limit the term to the cerebellum, which latter is only a dorsal hypertrophy, not an entire segment. The difficulties which Prof. Wilder mentions could be obviated by abandoning the term altogether.

LEMNISCI W.—Can be identified in cat on transverse section; they are not distinct on the surface, nor indeed there well marked in any animal.

LOCUS NIGER.—This ganglion is not black in any animal except man; for this reason I have employed the non-committal designation of *Ganglion Soemmeringii*.[6] It is interposed between *pes* and *tegmentum* like a *diaphragma*.

MONTICULUS.—Modern authors[2], to my knowledge, employ this term only for the highest point of the dorsal cerebellar vermis.

NUCLEUS LENTICULARIS. Might be briefly termed *lenticularis*.

PONTIBRACHIUM, W.—Is identical with the *medipedunculus* of the same author. I have thought that analogous names might be adopted for the other *pedunculi*, thus *Restibrachium*, etc.

STRIATUM. W.—Why not *caudatus*? Both *lenticularis* and *caudatus* are parts of the old *corpus striatum*.

VENTRIPYRAMIS, W.—Since the "posterior pyramids" of descriptive anatomy are no longer known as pyramids, and the more generally used term of *Clavæ* has been employed to designate their intumescence, the prefix *ventri* may not be necessary.

4. Independently of the question of nomenclature, I should like to ask upon what grounds it is stated that *cerebrum* consists of the *prosencephalon* less the *striata*. The tissue of the cortex cerebri and of the two divisions of the *corpus striatum* are even in man continuous, and it would be impossible to peel out the lenticular nucleus from the white substance of the hemispheres. Indeed, embryologically the cortical gray and that of the cerebral ganglia are originally subendymal, and in tracing the development of the brain, as we proceed from reptiles to

man, we find that successively the *caudatus*, the *lenticularis* and the *claustrum* become differentiated from a common gray mass continuous with the cortex at the base of the cerebrum.

I would add in regard to the term CORTEX that the Optic lobes[3, 6] and the Rhinencephalon[5] exhibit the cortical structure as the cerebrum and the cerebellum.

The following terms not included in Professor Wilder's series, are submitted, and for them I invite the severest criticism. Some of them are established by others.

CAPPA (*cinerea*[7])—The gray cap covering the *Optici*, well developed in most mammalia, rudimentary in man.

ECTOTHALAMUS*.—The outer gray thalamic zone.

ENTOTHALAMUS*.—The inner gray thalamic zone.

INTERCRURALE*, (*Ganglion*).—*Ganglion Interpedunculare*[3, 4].

SIGMA*.—The *S* shaped involution of the nerve-cell layer of the cortex which constitutes the basis of the *Hypocampa*.

NUCLEUS TRAPEZII*. — The superior olive. The development of this body seems to bear an inverse relation to that of the true olive. In man the olive proper is highly developed, in the cat poorly—in the latter the nucleus of the trapezium is well marked and folded; in man it is ill-marked.

OBLONGATA*.—The post-pontinal area of man; the *medulla oblongata*.

STRIÆ*.—The *striæ medullares albæ* of the fourth ventricle.

VELUM CEREBELLI*.—The valve of Vieussens; this is the true embryonic starting point of the Cerebellum. The *velum medullare anterius*.

VELUM OBLONGATÆ*.—The *velum medullare posterius*. It arises from the internal division of the *post pedunculus* in its oblongata portion, and covers the posterior part of the fourth ventricle.

VELUM FLOCCULI*.—The *velum medullare inferius*.

GRACILIS* (*Funiculus*).—*Funiculus gracilis*, continuation of corresponding column in cord; part of the posterior pyramids.

CUNEATUS* (*Funiculus*).

TUBERIS* (*Funiculus*).—Funiculus of Rolando; the columnar field containing the Tuberculum of Rolando. There is a *lobulus tuberis*, which is otherwise provided for.

NODI*.—Two symmetrical eminences, situated each in the shallow depression bounded by the *opticus, thalamus* and *habena*, probably corresponding to the *ganglion habenæ (Gangl. habenulæ*[5]*)*. There is a notable large opening cephalad of these eminences, which resembles the opening under the *tænia* containing the vein which gives the latter its bluish color. I can find no notice of this opening anywhere. The eminences are represented obscurely in Fig. 70 of Henle[2].

DECUSSATIO FONTINALIS.**—Fontanen artige Haubenkrenzung.[5]

In conclusion, I would urge the adoption of some brief arbitrary affix or prefix in place of the words commissure and ganglion. He who limits himself to a study of surface contours will not appreciate the absence of such abbreviations as much as he who is compelled to wade through the labyrinth of the internal cerebral structure.

Gris for ganglion would perhaps do; thus *Grishabena, Gristegmentum, Grisfastigium* for *Ganglion habenæ, Ganglion* and *Nucleus tegmenti, Nucleus fastigii*. The term *nucleus* is a very unfortunate one as it has another and very different meaning, which in my experience as a teacher of cerebral anatomy, has led to confusion in the mind of every beginner. Professor Wilder, who appears to be as much at home in etymology as in cerebral anatomy, will solve these problems no doubt better than I could pretend to.

* Terms proposed by myself, not to be found in previous publications.

** A single affix or prefix might be devised in place of *decussatio*, or *fontidecussatio, pinidecussatio, pyridecussatio?*

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3. *Forel.* Untersuchungen uber die Hauben Region, Arch. für Psychiatrie, VII.
4. *Gudden.* Ibidem, X.
5. *Meynert.* Vom Gehirn der Saugethiere. Stricker's Handbuch II. p. 724, line 11 from bottom.
6. *Spitzka.* The higher ganglia of the mid and hind brain. Journal of Nervous and Mental Diseases. July, 1880. (Designation of figure 10.)
7. *Schwalbe.* (Hoffmann-Schwalbe), quoting Tartuferi. *Gazetta medica Italiani.* Serie VIII[a]. Tom. III. and *Rivesta sperimentale*, 1878.

NEW YORK, 130 East 50th street. E. C. SPITZKA.

HOW DOES GRAVITY CAUSE MOTION?

To the Editor of "SCIENCE:"

The interesting article by Mr. E. L. Larkin in "SCIENCE" for March 26, on the Interrelations of Gravity, Heat, Motion, etc., induces me to offer you some thoughts on the subject, with the hope that I may throw light upon it from another point of view. There is one widely accepted doctrine of modern physics which I confess I could never understand, that of Potential Energy. It may serve as a convenient explanation of the mysteries of falling force to say that energy may be at one time motion, and at another time the possibility of becoming motion. The rule explains the problem, but what explains the rule? Can motion become anything else than motion? Can it now convert itself into Rest, into Gravity, into Potentiality, or into anything else than simply motion? Is it not, like force and matter, an unvarying infinitude of the universe?

Motion means simply the translation of substance through space, and it possesses a fixed energy dependent upon the weight of the substance and the speed of the translation. If the portion of substance moved be a minute portion of matter, either forming an elementary constituent of a solid mass, or a separate molecule of a gas, we call its motion heat; and the result of its impact with exterior particles, temperature. If it be a mass of such particles its translation should be particularized as mass motion. In addition to these modes of motion, Electricity and Magnetism must also be considered as more special modes of motion, unless we admit the possibility of motion becoming something else, and this something else again becoming motion.

Can we admit this? What does terrestrial gravity teach us? If gravity is convertible into motion, then we have reason to conclude that the gravity should disappear as the motion increases. The law of gravitation asserts that the action of the earth and of a falling body are necessarily reciprocal. The earth must fall towards the body with the same energy that the body displays in falling towards the earth. The body, then, can not derive its energy of fall from the earth, unless we claim that the earth derives its energy of fall from the body. Such a cross-lending of force is inadmissable. The energy displayed by the body must come from itself, not from the earth. It is not a transformation of the earth's gravity into motion. Is it a transformation of its own? This we cannot admit, since the body loses no gravity. It cannot well give and keep at the same time. The body falls 16 feet in the first second, and ends with a velocity of 32 feet per second. This 32 feet per second is a positive momentum, and must continue until over-

come by counter force. But if a portion of the gravity of the body has become transformed into this motion there will certainly be less to tr nsform during the next second. Yet in the next second the body adds to its 32 feet per second 16 feet more derived from gravity, and thus falls 48 feet, ending with a velocity of 64 ieet per second. In the third second it adds 16 feet to this 64, and falls 80 feet. And so on continuously, so far as observation has gone.

This certainly does not look like a transformation of gravity into motion, since the gravity appears to continue undiminished. And as to potential force, or possibility of motion, being converted into motion, I shall not attempt to combat it, for it is a sorry task to wrestle with an antagonist who changes into a mist when you attempt to grasp him. Gravity is something definite, whatever that something is, but this will-of-the-wisp of potentiality certainly lacks the bones of a solid body.

But if not gravity or potentiality what is it that becomes motion in the ball that falls towards the earth, and in the earth that falls towards the ball? This may seem a difficult question, and yet it admits of but one answer. Nothing becomes motion. Nothing can become motion. Motion is motion and cannot possibly be or become anything else. The motion which appears in the falling body was not created for the purpose. It existed in the falling body in some other form, and has been simply transformed, not created. Every mass of matter has its internal motions; its electrical, magnetic and chemical energies, which are more or less engaged in preserving the integrity of its molecules or of its mass; and its heat energy, which is engaged in a constant effort to overcome the integrity of its mass. The particles of the mass dart backward and forward continually. They would dart in one direction only were they not restrained by each other's resisting energies, and by external resistance. Consequently, any external energy which aids their vigor of movement in one direction and resists it in the opposite must give them a combined excess of vigor in that direction. They must all move more vigorously in that direction than in the opposite; that is, the mass must move as a whole in that direction. And this movement once gained is positive until overcome by exterior resistance. It is a definite energy which cannot be lost unless it be given to some other substance.

Such is the true principle at work in falling motion. Terrestrial gravity is the external energy which aids the vigor of the heat motion of particles in one direction and resists it in the other. This force is increasing. Although a mass be not falling to the earth its particles are incessantly falling. The supporting body resists their fall and their excess energy in this direction expends itself upon this body. But if the support be removed there is no longer any resistance to their fall. The particles strike further downward than they return, since gravity aids their down stroke and retards their upstroke. Thus at each vibrarion ot the particles the mass slightly descends. These slight descents continue. They are the energy derived from the pull of gravitative attraction. But each slight descent produces a fixed vigor of downward motion of the mass as a whole, and this vigor of motion is increased by constant new increments, so that the falling speed of the body rapidly increases.

This is the true meaning of potential energy—a change in the direction of motions already existing. No motion is created, or borrowed from any other condition of nature. The body gains force in one direction under the pull of gravity, but it is the force of a motive vigor which it already possessed, and which, instead of exerting itself equally in all directions, now exerts part of its energy specially in one direction. And this change in the direction of its energies is balanced by an equal opposite change in the direction of the earth's energies. The body does not possess the possibility of always falling, but it possesses the reality of always falling. Its particles constantly fall. But when it is supported their falls cannot accumulate. Each single fall is too slight to be observed, and the effect of each fall is overcome by resistance before another can be added to it. But these persistant falls produce a constant pressure upon the resisting substance, and constitute the weight of the body. It is on removal of the support that these rapidly repeated effects can be continuously added to each other, and become a visible descent. But the distance of the fall of the particles during each vibration is the same whether the body be supported or rapidly descending. It is only the preservation and accumulation of the positive mass motion given to the body by each slight fall, which causes the rapid increase in falling speed. These accumulating motions form an energy of motion separate from that of the fall, and which would keep the mass in motion at a fixed rate of speed were the force of gravity to suddenly vanish.

I would like to say a word here in reference to the presumed heated condition of the nebular mass from which it is claimed that the solar system originated. There is another reason than that advanced by Mr. Larkin, which renders it very improbable that the nebula was greatly heated. It is one thing to contain heat, another thing to be in what we call a heated state, that is, in a state of high temperature. For temperature and absolute heat are very different things. A mass of water at 32° contains far more heat than a mass of ice at the same temperature. And so a mass of water gas at 212° contains far more heat than an equal mass of water at that temperature. This rule probably holds good in all cases; namely, that as density diminishes the heat capacity increases, so that a very rare gas may contain a vastly greater quantity of heat than a solid at the same temperature. We see this exemplified in the matter of space. Heat has been pouring into it from the contracting spheres for an enormous period, yet its capacity for heat is so excessive that this outflowing heat has probably had very little effect in raising its temperature.

Such a consideration applies directly to the original nebula of the solar system. It was a very rare gas, and therefore had great capacity for heat. Its latent heat may have been great, and its effective temperature low. It was only after it began to rapidly lose heat that its temperature rose. For the contraction of the nebular mass must have, by condensing its substance, lessened its capacity for heat. If this change in condition took place more rapidly than radiation could balance it there must have been a steady increase in temperature, instead of a decrease as usually assumed. For all that we know to the contrary this phase of the process may not yet be completed. Contraction of the solar mass may yet be increasing its sensible heat, by lowering its capacity for heat, or its power of containing latent heat, more rapidly than this is balanced by radiation. In such a not impossible condition of affairs the sun would be yet rising instead of lowering in temperature, losing heat while increasing its apparent or sensible heat, and its process of actual cooling be not yet begun.

2223 Spring Garden St. Philadelphia. CHARLES MORRIS.

A CAUSE OF DETERIORATION IN CLOTH.—Goods dyed rust, buff, or chamois shades with salts of iron occasionally undergo a slow combustion. The ferric oxide is alternately reduced by the organic matter of the tissue and re-oxidized by the oxygen of the air.

AT a Berlin feather-dyeing establishment an ostrich feather dyed in shades with methyl-violet was layed upon a paper upon which some ammonia had been poured but had dried up again. After a time the feather became partially green, the green passing gradually into violet, and producing an extraordinary effect. This reaction is being utilized in feather-dyeing, and will probably be applied in the manufacture of artificial flowers.—M. BALLAND.

NOTES.

PERIODIC MOVEMENTS OF THE GROUND.—P. Plantamour gives an account of his observations on the movements of the ground from October 1, 1879, to September 30, 1880. The most remarkable feature is the sinking manifested on the eastern side from the end of November, 1879, to the end of January, 1880, which is much greater than might be expected from the absolute cold of the month of December, only —15°. A rise of temperature is always accompanied with an elevation of the ground level, and a fall of the thermometer is marked by a subsidence.

ON M'BOUNDON, THE ORDEAL POISON OF THE NATIVES OF THE GABOON; NEW PHYSIOLOGICAL, CHEMICAL, HISTO-CHEMICAL AND TOXICOLOGICAL RESEARCHES.—The poison employed contains exclusively one base, strychnine. E. Heckel and F. Schlagdenhauffen propose to examine whether the distinction between the tetanising and the paralysing species of the strychnos family may not depend simply on the proportion of the base which they contain.

ELECTRIC PHENOMENA OF TOURMALINE AND OF HEMI-HEDRAL CRYSTALS WITH INCLINED SURFACES.—The hypothesis which J. and P. Curie put forward is that there exists a constant difference of tension between the opposite surfaces of two successive layers. Tourmaline being a compound body the different parts of a crystalline molecule may be formed of different substances, which would explain the difference of tension of the opposite extremities of two molecules.

VIOLET ILLUMINATION OF THE RETINA UNDER THE INFLUENCE OF LUMINOUS OSCILLATIONS.—A. Charpentier, fixing his eyes immovably on a sky illuminated by a uniform white light, and moving two fingers of his right hand rapidly and alternately backwards and forwards before them, saw, after a minute, a remarkable change in the uniform aspect of the heavens. There appeared on a white ground a mosaic composed of rather deep violet-purple hexagons, separated from each other by white lines, and forming a very regular design. The oscillations of the fingers should be from 300 to 400 per minute. He thinks that these hexagons are due to the cones in the fovea and in the yellow spot, and that the white lines are due to their intervals.

A GLYCOSIDE EXTRACTED FROM COMMON IVY.—The glycoside in question, $C_{64}H_{54}O_{22}$, is resolvable into a non-fermentible sugar, which reduces Fehling's liquid, and a neutral body, tasteless, inodorous, dextro-rotary, and agreeing with the formula $C_{52}H_{44}O_{12}$.—L. VERNET.

RADIOPHONY.—Radiophonic effects are thermic, not luminous, and are produced by gases alternately heated and cooled, and not by solids or liquids.—E. MERCADIER.

PERMANENCE OF HYDROCYANIC ACID FOR A MONTH IN THE BODIES OF ANIMALS POISONED WITH THE PURE ACID.—Hydrocyanic acid, if administered in a sufficient quantity to animals, preserves them perfectly for a month. It remains in the tissues, and especially in those of the stomach for the same time. It appears to combine intimately with the animal tissues. In the Carnivora it is more difficult to extract it by distillation than in the Herbivora. C. BRAME.

INFERIOR ORGANISMS PRESENT IN THE AIR.—The microscopic beings in the air are very unequally distributed. The germs of beer-yeast are not everywhere present. Bacteria are much less common than the moulds, such as *Penicillium glaucum*, *Mucor stolonifer*, etc.—E. C. HANSEN.

CHEMICAL CONSTITUTION OF ALBUMEN.—The transformation of albumen into peptones is produced by a hydratation, which in each phase takes place at a fixed part of the molecule. The regressive formation of albumen from its peptones is produced by a similar de-hydration. When the molecule loses calcium and phosphoric acid the carboxylic groups appear, and give an acid reaction to the groups thus obtained. In certain phases the molecule may lose a portion of sulphur without being destroyed or changing its properties.—DR. A. DANILEWSKY.

NEW RESEARCHES ON THE ALBUMENS OF MILK.—The albumen of milk is a mixture of stroma-albumen, with small quantities of orro-proteine and the synto-protalbes. The lacto-proteine of Millon and Commaille is a mixture of soluble synto-protalbes, of snytogenes, and of peptones, which alone are precipitated by mercuric chloride. The same mixture with small quantities of peptones represents the galactine of Morin.—DR. DANILEWSKY AND P. RADENHAUSEN.

DEVELOPMENT OF THE CADAVERIC ALKALIES (PTOMAINES).—MM. Brouardel and Boutmy have verified the presence of these poisons in the viscera of persons who had died either from the action of poisons or otherwise. The organs of an individual asphyxiated by carbonic oxide were analysed some hours after death, and found free from poison. On being re-examined eight days afterwards they contained a solid organic base, presenting the general characters of the alkaloids and proving fatal in small doses to frogs and guinea-pigs. The ptomaines are produced in the dead bodies of men and animals, and vary in their nature under circumstances not yet ascertained. They are poisonous in the majority of cases.

REPORT PRESENTED BY M. TROOST ON BEHALF OF THE COMMITTEE OF THE CHEMICAL ARTS ON THE MALLEABLE NICKEL OF MM. GASPARD AND BELLE.—The metal is first brought to a state of complete fusion, its surface is freed from all traces of scoriæ, a small quantity of metallic zinc or magnesium is introduced, the whole is stirred up and run. The metal thus added seems to lay hold of all traces of foreign matter derived from the sides of the crucible. Such nickel is ductile and malleable at all temperatures below its point of fusion, and can be welded either with itself or with iron or steel. Plates and wires of iron or steel can thus be coated with nickel.

SPECIFIC MAGNETISM OF OZONE.—Ozone being more magnetic than oxygen it is easy to see that the relation of the specific magnetism of ozone to that of oxygen is notably greater than the supposed relation of their densities. The specific magnetism of ozone is then greater than what would correspond to the quantity of oxygen which it contains.—H. BECQUEREL.

DETECTION OF ERGOT IN FLOUR.—The suspected sample is treated with cold ether or boiling alcohol to dissolve the greater part of the coloring-matters of the flour. The residue is then extracted with ether, mixed with a small quantity of sulphuric acid, and the extract is examined with the spectroscope. The ethereal extract of ergot, if concentrated, absorbs all the refrangible portion of the spectrum beyond D; if the solution is diluted, the spectrum is enlarged, and there appear three absorption bands: the first between D and E, wave-length 538; the second between E and F, wave-length 467. Hoffman agitates the acid ethereal extract with a little solution of sodium bicarbonate, which seizes the coloring-matter of the ergot and takes a fine violet color, whilst the coloring-matters of the flour remain in the ether.

ADDENDA.

In "SCIENCE," March 2, in paper on Amplitude of Vibration of Atoms, for paragraph beginning: "For other atoms than hydrogen," etc., read, "For other atoms than hydrogen, where they have the same energy, their amplitude will vary inversely as the square root of their mass, so that for oxygen the amplitude at 0° will be $\frac{.162}{\sqrt{16}} = .04$ its diameter and its maximum temperature will be $6419 \times 4 = 25676°$ Cent. Also the maximum temperature of the sun would be about 500000° Cent." A. E. D.

THE ODONTORNITHES.—In our last week's notice of the Odontornithes, in the middle of the second paragraph, on page 148, the dental series are said not to "reach the tip of either jaw." In place of "either" substitute "the upper."